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(54) IMPROVEMENTS IN OR RELATING TO CONTROL OF FLUID FLOW

(71) We, CRINOSPITAL SPA, an Italian company, of Via Crema, Palazzo Pignone, Cremona, Italy, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

This invention relates to a device for controlling the flow of fluid through a flexible tube. The invention is particularly but not exclusively useful in connection with medical/clinical applications, such as transfusions, infusions, peritoneal, hyperdialysis and also laboratory or chemical applications, where a precise metering of fluid flow at low throughput is required.

The apparatus already known for transfusions or infusions generally comprises a needle to be driven through the cap of the container storing the liquid to be infused, which is connected, through a flexible tube, to a stopcock chamber or drip having a second flexible tube extending therefrom and whose end can fit the injection needle. To the latter flexible tube, at an intermediate location between the drip and the needle, a clamp is fitted for controlling the infusion liquid flowrate. Such clamps, or similar means, presently in use do not give good control of the flowrate which is likely to fluctuate during the operating period. In fact such clamps or similar means, when in the operative position, press tightly the flexible tube walls so that the tube walls become flattened and warped, while two very sharp kinks are simultaneously formed, which tend to buckle the tube wall in a transverse direction. When the clamp is then wholly or partially released, to allow for the passage of a controlled flow of liquid, the original setting tends to change since the substantially resilient material of the tube walls cannot readjust instantaneously to the new operating conditions, since it has been subjected to high stress. The effective cross-sectional area of the tube may therefore show slight variations, over a period,

directly affecting the rate of flow of the liquid therethrough.

The device according to this invention is designed to replace the clamps or similar devices now in use, in order to give a more precise setting of the liquid flowrate, which is very important when, for medical or surgical purposes, the use of minimal and controlled quantities of particularly active or dangerous products is required.

In accordance with the invention, a device for controlling the flow of fluid through a flexible tube comprising a longitudinally extending hollow body with longitudinally opposed apertured walls for accommodating the tube, the body having a transverse apertured wall and tube engaging means operable through the aperture of said transverse wall for controlling the flow of liquid through the tube, wherein the said tube engaging means comprises a lever extending through the aperture of the transverse wall and is adapted for pivotable movement with respect to said aperture, said lever having an arm portion located outside the body and a hooked portion located within the body, said hooked portion encircling the periphery of the tube within the body, so that when in use pressure is applied to the arm portion of the lever to pivot it towards the body and to move the hooked portion towards the aperture in the transverse wall, the section of the hooked portion of the lever on the far side of the tube from the lever arm compresses the tube in one direction, while the section of the hooked portion of the lever nearest to the arm portion compresses the tube in the opposite direction.

In a preferred embodiment of the invention the device comprises a hollow body having a pair of apertures through which a flexible tube can enter and leave the body, the body having an opening in which is mounted a control member comprising an arm portion exterior of the body and a hooked portion within the body, the arrangement being such that in use pressure on the arm

portion to cause the arm to move in a direction towards the body compresses the hooked portion to compress the walls of a flexible tube passing through the body, thus controlling the flow of fluid through the tube.

The hollow body may be formed from two substantially equal sized members force fitted together with apertures through opposed walls of the members through which the flexible tube can pass.

Advantageously there is mounted on the hollow body a slidable retention means capable in use of retaining the control member in a desired operative position.

The device may be formed from a suitable metal or a rigid plastics material.

In order that the invention may be more clearly understood an embodiment thereof will now be described by way of example with reference to the accompanying drawing in which—

Figure 1 is a diagrammatic longitudinal cross-section through a control device for fluid flow through a flexible tube, the device being in an inoperative position; and Figure 2 is another diagrammatic longitudinal cross-section showing the device of Figure 1 in an operative position.

Referring now to the accompanying drawing, a device for controlling the flow of fluid through a flexible tube comprises a pair of members 1 and 2 fitted together to form a hollow rectangular body. Mounted in the member 1 is a slider 4 which operates on guide ribs (not shown) fixed to member 1. The extreme position of the slider are as indicated in Figures 1 and 2 respectively. An opening 3 accommodates a lever generally designated at 6 comprising an arm portion 3 and a hooked portion 7. The arm portion 3 is substantially straight and the hooked portion 7 is of a shape such as to be capable in use of bearing on the outer wall of a tube 9 passing through the device so as to prevent flow of fluid therethrough. The flexible tube 9 can be connected to a rigid tube 10. A push rod 11 and a pivotal point 14 can be used to depress the arm portion 3 so as to cause the lever 6 to become operational.

The tube 9 is formed from a resilient material, preferably a non-cured rubber. The tube can be of substantially circular cross-section, although it is preferably of elliptical cross-section, so that deformation can more easily occur in the direction of the minor axis of the ellipse.

To use the device as described above, the arm portion 3 is depressed by pressure applied via the push rod 11. The push rod 11 reciprocates in a direction as indicated by the arrow A. The push rod is normally manually operated for small, constant flowrates, such as for normal infusions. However the push rod may be controlled by an

automatic fitting when the flowrate varies with time and has to be continuously adjusted.

According to the pressure applied, the control lever can assume any intermediate position between the two extreme positions indicated in Figures 1 and 2. Once the desired position has been set, it is possible to keep lever 3 in position, during manual operation, by slider 4 which reciprocates along guide ribs extending laterally along member 1. Figure 2 shows the lever in the completely locked position. Figure 1 shows the slider in its non-operative position with the lever held in its non-operative position by the flexible tube 9.

The above-described device may form an integral part of a disposable, sterile and aseptic assembly, which is supplied protected and ready for service under the usual name of an infusion or transfusion set. Such an assembly is normally used only once and is then disposed of after use.

WHAT WE CLAIM IS—

1. A device for controlling the flow of a liquid through a flexible tube comprising a longitudinally extending hollow body with longitudinally opposed apertured walls for accommodating the tube, the body having a transverse apertured wall and tube engaging means operable through the aperture of said transverse wall for controlling the flow of liquid through the tube, wherein the said tube engaging means comprises a lever extending through the aperture of the transverse wall and is adapted for pivotable movement with respect to said aperture, said lever having an arm portion located outside the body and a hooked portion located within the body, said hooked portion encircling the periphery of the tube within the body, so that when in use pressure is applied to the arm portion of the lever to pivot it towards the body and to move the hooked portion towards the aperture in the transverse wall, the section of the hooked portion of the lever on the far side of the tube from the lever arm compresses the tube in one direction, while the section of the hooked portion of the lever nearest to the arm portion compresses the tube in the opposite direction.

2. A device as claimed in Claim 1, and further comprising an arm retaining means slidably mounted on the body for holding the lever in a fixed position.

3. A device for controlling the flow of fluid through a flexible tube, substantially as hereinbefore described with reference to, and as shown in, the accompanying drawing.

4. A flexible tube having fitted thereon a device as claimed in any preceding claim.

5. An infusion or transfusion apparatus comprising a flexible tube as claimed in claim 4.

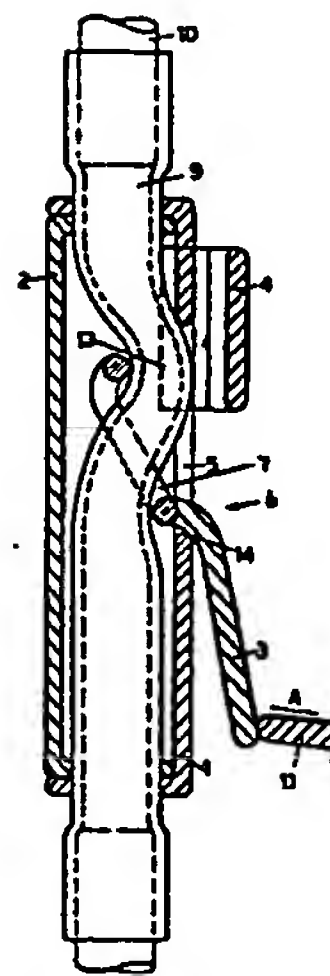


Fig. 1

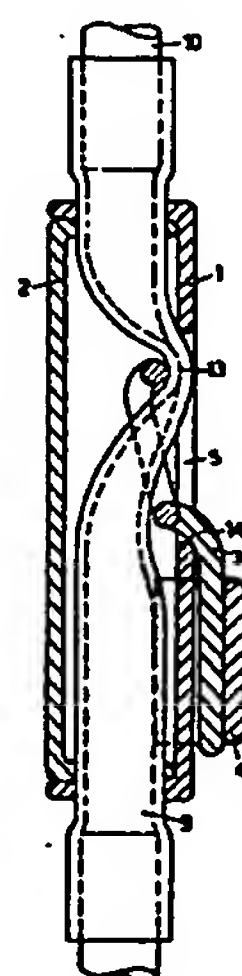


Fig. 2

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